

WHAT IS CLAIMED IS

1. A vibration sound reducing device comprising a vibration absorbing means which is mounted to a passage defining structure defining a liquid passage faced by at least a portion of a vibration generating section, said vibration absorbing means absorbing the vibration transmitted from said vibration generating section through a liquid in said liquid passage, wherein said vibration absorbing means comprises an occluding member mounted to an outer wall of said passage defining structure so as to occlude a through-bore which is provided in the outer wall of said passage defining structure and opens at an inner end thereof into said liquid passage, an elastic membrane with one of opposite surfaces thereof facing said liquid passage and the other surface thereof facing a space defined between said elastic membrane and said occluding member, and a retaining member mounted to said occluding member for retaining said elastic membrane between said retaining member and said occluding member.

2. A vibration sound reducing device according to claim 1, wherein said occluding member has a cylindrical mounting portion projectingly provided at an inner end thereof; said elastic membrane includes an endless sealing portion which is in contact with a tip end face of said mounting portion, and a membrane portion formed at a thickness smaller than that of said sealing portion and integrally connected to an inner periphery of said sealing portion with a step formed

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therebetween; and said retaining member mounted to said occluding member with said sealing portion sandwiched between said retaining member and the tip end of said mounting portion is provided with a positioning portion which is engaged with the inner periphery of said sealing portion to position said elastic membrane in a plane perpendicular to an axis of said mounting portion.

3. A vibration sound reducing device according to claim 1, wherein said occluding member has a cylindrical mounting portion projectingly provided at an inner end thereof; said elastic membrane includes an endless sealing portion which is in contact with a tip end face of said mounting portion, and an annular lip portion protruding outwards from an outer periphery of said sealing portion; and said retaining member mounted to said occluding member with said sealing portion sandwiched between said retaining member and the tip end of said mounting portion is provided with a cylindrical portion which comes into contact with the outer periphery of the lip portion to position said elastic membrane in a plane perpendicular to an axis of said mounting portion.

4. A vibration sound reducing device according to claim 1, wherein said retaining member is press-fitted over the occluding member with an outer periphery of said elastic membrane sandwiched between said retaining member and said occluding member, and said occluding member is provided with a limiting portion for limiting an end of movement of said

retaining member in a direction of press-fitting over said occluding member.

5. A vibration sound reducing device according to claim 1, wherein said occluding member is provided with an annular engage portion which is engaged with said elastic membrane over an entire periphery of the elastic membrane to position said elastic membrane in a plane perpendicular to an axis of said through-bore.

6. A vibration sound reducing device according to claim 1, wherein said vibration generating section is a cylinder portion which is provided in a cylinder block in a water-cooled internal combustion engine, said cylinder portion having a piston slidably received therein, and said passage defining structure is an engine body which includes the cylinder block and which is provided with (1) a cooling water passage defined as said liquid passage including a water passage portion surrounding said cylinder portion, and (2) said vibration absorbing means for absorbing the vibration transmitted from the cylinder portion through the cooling water in said cooling water passage.

7. A vibration sound reducing device comprising a vibration absorbing means which is mounted in a passage defining structure defining a liquid passage faced by at least a portion of a vibration generating section, said vibration absorbing means absorbing the vibration transmitted from said vibration generating section through a liquid in said liquid passage, wherein said vibration absorbing means comprises an occluding

member which is mounted to an outer wall of said passage defining structure so as to occlude a through-bore which is provided in the outer wall and opens at an inner end thereof into said liquid passage, and an elastic membrane press-fitted over and fixed to said occluding member with one of opposite surfaces thereof facing said liquid passage and the other surface thereof facing a space defined between said elastic membrane and said occluding member.

8. A vibration sound reducing device according to claim 7, wherein said occluding member has a cylindrical mounting portion projectingly provided at an inner end thereof, and said elastic membrane includes a cylindrical sealing portion press-fitted over an outer periphery of said mounting portion, and a membrane portion connected to an end of said sealing portion to define a space between said membrane portion and said occluding member, said sealing portion being provided with a ring-shaped reinforcing member.

9. A vibration sound reducing device according to claim 8, wherein said reinforcing member is mounted within said sealing portion in such a manner that said reinforcing member is entirely wrapped with said sealing portion.

10. A vibration sound reducing device according to claim 8, wherein said elastic membrane is provided with a slip-off preventing portion which is resiliently engaged with said occluding member for inhibiting said elastic membrane from falling off said occluding member.

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11. A vibration sound reducing device according to claim 7, wherein a sealing portion of said elastic membrane is provided with a slip-off preventing portion which is resiliently engaged with a mounting portion of said occluding member for inhibiting said elastic membrane from falling off said mounting portion, said slip-off preventing portion being located inside said reinforcing member.

12. A vibration sound reducing device according to claim 7, wherein said occluding member has a cylindrical mounting portion projectingly provided at an inner end thereof, and said elastic membrane includes a cylindrical sealing portion press-fitted over an outer periphery of said mounting portion, and a membrane portion connected to an end of said sealing portion to define a space between said membrane portion and said occluding member, the thickness of said sealing portion being set larger than that of said membrane portion.

13. A vibration sound reducing device according to claim 7, wherein said vibration generating section is a cylinder portion which is provided in a cylinder block in a water-cooled internal combustion engine, said cylinder portion having a piston slidably received therein, and said passage defining structure is an engine body which includes the cylinder block and which is provided with (1) a cooling water passage defined as said liquid passage including a water passage portion surrounding said cylinder portion, and (2) said vibration absorbing means for absorbing the vibration transmitted from said cylinder

portion through the cooling water in said cooling water passage.

14. A vibration sound reducing device comprising a vibration absorbing means which is mounted in a passage defining structure defining a liquid passage faced by at least a portion of a vibration generating section, said vibration absorbing means absorbing the vibration transmitted from said vibration generating section through a liquid in said liquid passage, wherein said passage defining structure is provided at an outer wall thereof with (1) a through-bore which opens at an inner end thereof into said liquid passage, and (2) a collar-shaped receiving portion protruding radially inwards from an inner surface of said through-bore, and said vibration absorbing means comprises an occluding member mounted to said outer wall to occlude said through-bore, and an elastic membrane having an outer periphery clamped between said receiving portion and said occluding member with one of opposite surfaces thereof facing said liquid passage and the other surface thereof facing a space defined between said elastic membrane and said occluding member.

15. A vibration sound reducing device according to claim 14, wherein said outer wall of said passage defining structure is integrally provided with a cylindrical boss portion having said through-bore; the outer periphery of said elastic membrane clamped between said receiving portion and said occluding member is provided with a protruding annular lip which is in close contact with said receiving portion of said occluding

member; and said occluding member is integrally provided with a limiting collar portion which is in contact with an outer end of said boss portion to limit an end of movement of said occluding member in a direction toward said receiving portion.

16. A vibration sound reducing device according to claim 14, wherein the outer periphery of said elastic membrane is provided with an engage portion which is engaged with said occluding member.

17. A vibration sound reducing device according to claim 16, wherein said occluding member is provided with a cylindrical portion which clamps the outer periphery of said elastic membrane between said cylindrical portion and said receiving portion, and the outer periphery of said elastic membrane is integrally provided with an engage portion which is formed into a cylindrical shape, so that said engage portion is resiliently fitted into an annular recess which is provided in an outer periphery of a tip end of said cylindrical portion, said annular recess having in a tapered shape with its diameter reduced toward said receiving portion.

18. A vibration sound reducing device according to claim 14, wherein said vibration generating section is a cylinder portion which is provided in a cylinder block in a water-cooled internal combustion engine, said cylinder portion having a piston slidably received therein; said passage defining structure is an engine body which includes said cylinder block and which is provided with a cooling water passage defined as said liquid

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passage including a water passage portion surrounding said cylinder portion; and said vibration absorbing means is mounted to the outer wall of said engine body for absorbing the vibration transmitted from said cylinder portion through the cooling water in said cooling water passage.

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19. A vibration sound reducing device comprising a vibration absorbing means which is mounted to a passage defining structure defining a liquid passage faced by at least a portion of a vibration generating section, said vibration absorbing means absorbing the vibration transmitted from said vibration generating section through a liquid in said liquid passage, wherein said vibration absorbing means comprises an occluding member mounted to an outer wall of said passage defining structure so as to occlude a through-bore which is provided in the outer wall of said passage defining structure and opens at an inner end thereof into said liquid passage, and an elastic membrane mounted to said occluding member with opposite surfaces thereof facing said liquid passage and a space defined between said elastic membrane and said occluding member, said elastic membrane being of such a shape that it is curved toward said occluding member, immediately before it comes into contact with at least said occluding member, when said elastic membrane is mounted to said occluding member.

20. A vibration sound reducing device according to claim 19, wherein said occluding member has a cylindrical mounting portion projectingly provided at an inner end thereof, and said

elastic membrane is formed into a cap-shape and comprises a cylindrical sealing portion fitted over and fixed to an outer periphery of said mounting portion, and a membrane portion connected to an end of said sealing portion while defining a space between said membrane portion and said occluding member.

21. A vibration sound reducing device according to claim 19, wherein said elastic membrane is formed into such a shape that it is expanded toward said occluding member in a natural state with no external force applied thereto.

22. A vibration sound reducing device according to claim 19, wherein said elastic membrane is assembled to said occluding member in a state in which said elastic membrane is urged by an urging member, so that it is curved toward said occluding member.

~~23.~~ A vibration sound reducing device comprising a vibration absorbing means which is mounted to a passage defining structure defining a liquid passage faced by at least a portion of a vibration generating section, said vibration absorbing means absorbing the vibration transmitted from said vibration generating section through a liquid in the liquid passage, wherein said passage defining structure is provided at an outer wall thereof with a mounting bore which opens at an inner end thereof into said liquid passage, and said vibration absorbing means comprises an occluding member mounted to occlude said mounting bore and including a cylindrical support tube portion having external threads provided around an outer periphery

thereof and threadedly engaged with internal threads provided on an inner surface of said mounting bore, and an elastic membrane mounted to an inner end of said occluding member with one of opposite surfaces thereof facing said liquid passage and the other surface thereof facing a space defined between said elastic membrane and said occluding member, said occluding member being provided with a tool-engaging bottomed bore which opens into an outer end of said occluding member, said tool-engaging bore being defined to have an axially extending portion disposed in said support tube portion within an axial region where said external threads are disposed.

~~24~~. A vibration sound reducing device comprising a vibration absorbing means which is mounted to a passage defining structure defining a liquid passage faced by at least a portion of a vibration generating section, said vibration absorbing means absorbing the vibration transmitted from said vibration generating section through a liquid in the liquid passage, wherein an outer wall of said passage defining structure is provided with a mounting bore which opens at an inner end thereof into said liquid passage, and said vibration absorbing means comprises an occluding member which is mounted to occlude said mounting bore and which includes a cylindrical support tube portion having external threads provided around an outer periphery thereof and threadedly engaged with internal threads provided on an inner surface of said mounting bore, and an elastic membrane mounted to an inner end of said occluding

member with one of opposite surfaces thereof facing said liquid passage and the other surface thereof facing a space defined between said elastic membrane and said occluding member, said occluding member being provided with a recess which opens into an inner end of said occluding member to define said space, an axially extending portion of said recess being disposed in said support tube portion within an axial region where said external threads are disposed.

25. A vibration sound reducing device comprising a vibration absorbing means which is mounted to a passage defining structure defining a liquid passage faced by at least a portion of a vibration generating section, said vibration absorbing means absorbing the vibration transmitted from said vibration generating section through a liquid in the liquid passage, wherein an outer wall of said passage defining structure is provided with a mounting bore which opens at an inner end thereof into said liquid passage, and said vibration absorbing means comprises an occluding member which is mounted to occlude said mounting bore and which includes a cylindrical support tube portion having external threads provided around an outer periphery thereof and threadedly engaged with internal threads provided on an inner surface of the mounting bore, and an elastic membrane mounted to an inner end of said occluding member with one of opposite surfaces thereof facing said liquid passage and the other surface thereof facing a space defined between said elastic membrane and said occluding member, the occluding

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member being provided with a tool-engaging bottomed bore which opens into an outer end of said occluding member, a recess which opens into an inner end of the occluding member to define said space, and a partition wall whose outer periphery is connected to an inner periphery of said support tube portion in a plane perpendicular to an axis of said mounting bore, said partition wall partitioning said tool-engaging bore and said recess from each other, opposite surfaces of said partition wall respectively defining a closed end of said tool-engaging bore and a closed end of said recess and being disposed on said support tube portion within an axial region where said external threads are disposed.

26. A vibration sound reducing device according to claim 25, wherein said partition wall is disposed at a central portion of said support tube portion within said axial region where said external threads are disposed.